DOCUMENT RESUME

ED 406 363 SP 037 256

AUTHOR Boe, Erling E.
TITLE Research on the Shortage of Teachers in the United States: Models, Methods, and Findings.
PUB DATE Nov 96
CONTRACT H023C10088-92A; H023C40102-95
NOTE 22p.; Paper presented at the Joint Meetings of the Education Research Association and the Australian Association for Research in Education (Singapore, November 1996).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Educational Environment; Elementary Secondary Education; *Employment Patterns; Models; Public School Teachers; Research Design; Surveys; *Teacher Certification; *Teacher Shortage; *Teacher Supply and Demand
IDENTIFIERS *Schools and Staffing Survey (NCES)

ABSTRACT

A shortage of teachers to staff primary and secondary schools is a common occurrence internationally. The fact of, or potential for, teacher shortages is a major consideration in any nation's aspirations of attaining, or maintaining, an educational system of high quality. To study and understand the nature of teacher shortages, it is first necessary to have a model, or conceptual framework. Therefore, a model was developed for conceptualizing teacher shortages in terms of quantity (i.e., gross numbers of teachers) and quality (i.e., qualifications of teachers). By using the Public School Teacher Question from the Schools and Staffing Survey (1991) as the data source, recent key findings about the type and scope of teacher shortages in the United States were reviewed. Data analysis showed that although there was a sufficient number of individuals available to fill all but 0.5 percent of all teaching positions, there was a serious shortage of teachers who were fully licensed in their particular teaching assignments (a shortage of about 150,000 licensed teachers, a group that constituted about 6 percent of the entire public school teaching force of 2,500,000 teachers). The findings revealed that the shortage of fully licensed teachers was more pronounced among: (1) teachers who had not earned degrees in teacher preparation, (2) novice teachers just entering the profession, (3) employed teachers who had recently changed teaching assignments, and (4) teachers of children with handicaps. The appendix provides definitions of terms. (Author/ND)

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RESEARCH ON THE SHORTAGE OF TEACHERS IN THE UNITED STATES: MODELS, METHODS, AND FINDINGS[1]

ED 406 363

A Paper Presented by

Erling E. Boe, Ph.D.

Visiting Professor
School of Education
National Institute of Education
Nanyang Technological University
Republic of Singapore

and

Professor of Education
Graduate School of Education
University of Pennsylvania
United States of America

at the joint meetings

of the

Education Research Association, Singapore

and the

Australian Association for Research in Education

held in the
Republic of Singapore

November 1996

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[1]Support for this research was provided by grants (Award Numbers H023C10088-92A and H0 23C40102-95) from the Research in Education of Individuals with Disabilities Program (CFDA Number: 84-023C), Division of Innovation and Development, Office of Special Education Programs, the U.S. Department of Education to Erling E. Boe at the University of Pennsylvania; by the National Center for Education Statistics, the U.S. Department of Education; and by the Center for Research and Evaluation in Social Policy, the Graduate School of Education of the University of Pennsylvania.

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Abstract

A shortage of teachers to staff primary and secondary schools is a common occurrence internationally. The fact of, or potential for, teacher shortages is a major consideration in any nations's aspirations of attain, or maintain, an educational system of high quality. To study and understand the nature of teacher shortages, it is first necessary to have a model, or conceptual framework, for defining teacher shortages. Therefore, this paper outlines a model for conceptualizing teacher shortages in terms of quantity (i.e., gross numbers of teachers) and quality (i.e., qualifications of teachers). By using a large national data base of teachers (kindergarten through grade 12) in the United States, recent key findings about the type and scope of teacher shortages were reviewed. Though there were a sufficient number of individuals available to fill all but 0.5% of all teaching positions, there was a serious shortage of teachers who were fully licensed in their particular teaching assignments (a shortage of about licensed 150,000 teachers, a group who constituted about 6% of the entire public school teaching force of 2,500,000 teachers). The findings revealed that the shortage of fully licensed teachers was more pronounced among (a) teachers who had not earned degrees in teacher preparation, (b) novice teachers upon entering the profession, (c) employed teachers who had recently changed teaching assignment, and (d) teachers of handicapped children.

Introduction

A shortage of teachers to staff primary and secondary schools is a common occurrence internationally. There certainly is a shortage of teachers in the United States of America (US) (Boe, Cook, Bobbitt, & Terhanian, 1996), as well as in other nations, even though the educational systems and societal contexts of education differ enormously cross-nationally.

The fact of, or potential for, teacher shortages is a major consideration in any nations's aspirations of attain, or maintain, an educational system of high quality. Teachers constitute the core of the workforce in education. They provide instruction, maintain discipline, and model responsible social behaviors and moral values for students. In fact, the importance of teacher qualifications to perform instructional roles has been confirmed by recent meta analyses of education production functions in the US. These analyses

have demonstrated that "variables that attempt to describe the quality of the teachers (teacher ability, teacher education, and teacher experience) show very strong relations with student achievement" (Laine, Greenwald, & Hedges, 1995, pp. 57-58).

Thus, a shortage of teachers can mean larger class sizes or lower quality instruction, or both. It is, therefore, entirely appropriate for education policy makers, administrators, and practitioners alike to take teacher shortages very seriously, and to try to minimize this problem.

To study and understand the nature of teacher shortages, it is first necessary to have a model, or conceptual framework, for distinguishing among, and defining, various aspects of teacher shortages. Consequently, the first purpose of this paper is to outline a model for conceptualizing teacher shortages. The second purpose is to describe methods that are used to study teacher shortages, while the third purpose is to report recent key findings about the type and scope of teacher shortages in the US.

Teacher Shortage Models

The general concept of a teacher shortage can be defined by subtracting the number of teachers required (often termed "demand") from the number of teachers available (often termed "supply").[1] A negative difference defines teacher shortage, while a positive number defines a teacher surplus. Thus, the shortage or surplus of teachers can be manipulated by changing either the requirements for, or the availability of, teachers. This relationship between requirement and availability can be represented by the following formula (labeled F1):

F1: (Teacher shortage) = (Teachers available) - (Teachers required)
(or surplus)

Although formula F1 defines the general concept of a teacher shortage, it does not take into account the numbers of teachers required and the numbers of teachers available in the intersections of three strata: (a) different subject matters (mathematics, art, physical education, etc., (b) different levels (primary, secondary, etc.), and (c) different locations (schools in South Philadelphia, PA, Lubbock, TX, etc). While there might be an overall surplus of teachers, there could well be a shortage within some specific strata. Therefore, to be most useful, teacher shortages need to be assessed within specific strata.

For the purposes of this paper, only teacher shortages will be considered (i.e. a negative difference in formula F1). Accordingly, several aspects of the variables used in F1 are defined below in the following order:

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[1]For an extended discussion of teacher supply and demand models, see S. Barro in Boe and Gilford (1992).

I. Teacher requirements
   A. Teacher need
   B. Teacher demand
      1. Quantity teacher demand
      2. Quality teacher demand
II. Teacher availability
   A. Quantity teacher supply
   B. Quality teacher supply
III. Teacher shortage
   A. Quantity teacher shortage
   B. Quality teacher shortage
      1. Relative to teacher need
      2. Relative to teacher demand

Teacher Requirements

Teachers Required: Need. One approach to computing the number of teachers required is to define the teacher need. A straightforward way to define the aggregate national need for teachers is to specify a desired teacher:pupil ratio (e.g., 1:25) and divide the number of students per teacher into the size of the enrolled (or projected) student population (e.g., 2,000,000), as shown in formula F2:

F2: (Teachers needed) = (Student population) / (Students per teacher)

Or, using the hypothetical national numbers from above:

80,000	=	2,000,000	/	25
(Teachers needed)		(Students)		(Students per teacher)

This method for computing the number of teachers required can be useful for planning purposes to test various scenarios for projected increases in student enrollment, preferred teacher:pupil ratios, or education funding schemes. It can be assumed that the numbers of teachers needed refers to teachers who are fully qualified for the teaching assignments that need to be filled, such as in general primary or in secondary chemistry. To be meaningful, therefore, computations of "teacher need" should be disaggregated by subject matter and level.

Teachers Required: Demand. The computation of "teachers needed," as described above, does not take into account the number of teaching positions that have been created and funded, or the number of classrooms available. If the hypothetical nation used above, with 2,000,000 students, had funded and filled positions for only 50,000 teachers, the teacher ratio must be 1:40

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regardless of how many might be "needed." Therefore, the second approach to computing the number of teachers required is to define the following two types of teacher demand in terms of actual teaching positions that have been created and funded:

1. Quantity teacher demand is defined simply by counting the number of teacher positions that have been created and funded for a specific school year, as shown in formula F3:

F3: (Quantity teacher demand) = (Number of funded teaching positions)

Since quantity teacher demand defines the actual number of teachers that can be hired at any one time (as distinguished from teachers needed or desired), it is one of two types of teacher demand that are used in this paper in the computation of teacher shortages.

2. Quality teacher demand is defined by counting the number of teaching positions that have been created and funded for a specific school year for teachers of particular qualifications. For example, national policy my require that all secondary level (but not primary level) teachers have earned at least a bachelor's degree. The quality demand for such teachers is shown in formula F4:

F4: (Quality teacher demand) (for bachelor's graduates) = (Number of funded positions) (requiring bachelor's graduates)

As another example, many countries require that all teachers have qualified for a standard/regular/full teaching license/certificate/diploma in their main teaching assignment (e.g., a mathematics teacher should be fully licensed in mathematics, not physical education or some other field). If this is the case, then the quality demand for such teachers is the same as quantity demand, as shown in formula F5 in comparison with formula F3:

F5: (Quality teacher demand) (for licensed teachers) = (Number of funded teaching positions)

Teacher Availability

Teacher Availability: Quantity Supply. Teacher availability, in the sense of teacher quantity supply, is defined as the number of individuals able and willing to accept concrete offers for employment as teachers. Note that this definition does not specify anything about the qualifications of these individuals to serve as employed teachers. Likewise, it does not address the potential supply of individuals who are able and willing to accept teaching employment in some teaching fields in some locations, but not in others. Quantity supply is defined here only as individuals able and willing to accept

concrete offers of employment for employment for specific teaching positions in specific locations.[2] The most concrete measure of the quantity supply of such individuals is the unduplicated count[3] of the number of applications submitted for teaching positions each year, including teachers who were employed during the preceding year and who intend to continue teaching. Unfortunately, the total size and composition of the quantity supply of teachers is not known (at least in the US) because data are not collected on the availability of such individuals. If such data were available, quantity teacher supply could be defined by formula F6:

F6: (Teacher quantity supply) = (Unduplicated count of individuals submitting applications for teaching positions)

Teacher Availability: Quality Supply. Teacher availability, in the sense of teacher quality supply, is defined here as the number of individuals (a) who are able and willing to accept concrete offers of employment as teachers, and (b) who hold the minimum qualifications specified for the teaching position offered. A particular qualification required may be the award of a standard/regular/full teaching license/certificate/diploma in the specific teaching assignment offered. A different qualification that may be specified is holding at least a bachelor's degree from a recognized institution of higher education. The most concrete measure of the quality supply of individuals with particular qualifications is the unduplicated count of the number of applications submitted by individuals holding qualifications required for the teaching positions applied for each year, including teachers who were employed during the preceding year and who intend to continue teaching. Unfortunately, the total size and composition of the quality supply of teachers is not known (at lease in the US) because data are not collected on the availability of such individuals. If such data were available, quantity teacher supply could be defined as in formula F7:

F7: (Teacher quality supply) = (Unduplicated count of individuals holding specified qualifications who submit applications for teaching positions)

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[2]The total quantity supply of teachers for a particular school year is typically drawn from a number of sources, such as the ranks of employed teachers during the prior school year, graduates of teacher preparation programs who are able and willing to enter teaching for the first time, and experienced teachers who have left the profession during prior years but who are willing and able to reenter teaching. See Boe and Gilford (1992) for a general presentation of teacher supply, demand, and quality.

[3]It is important that quantifying the supply of applicants for teaching positions be based on an unduplicated count of such applicants because, in countries such as the US, it is possible for an individual to apply for many teaching positions, either in different subject matters in the same school or in different schools, or both. This is true as well for employed teachers in one year who wish to continue teaching during the following year.

Teacher Shortage

Because data are not ordinarily collected on the quantity and quality supply of teachers, as defined above, very little is known about these phenomena. They are, without question, the least understood aspect of research and on teacher supply and demand. Theoretically, it is possible that teacher supply might be sufficient in gross numbers to satisfy teacher demand, but that the supply is inadequately distributed across teaching fields, schools, and locations. To be adequate, teacher supply must be sufficient in numbers, qualifications, and availability to fill open teaching positions wherever they may exist. Therefore, in the absence of data on teacher supply and the importance of filling open teaching positions, practical definitions of teacher shortage must take both these factors into account. The definitions of teacher shortage presented below do this and can be quantified with data that are often available.

Quantity Teacher Shortage. Since teacher quantity supply is not ordinarily quantified by educational administrators or statisticians, formula F1 can not be used to compute quantity teacher shortage. However, it is possible to known if the quantity supply is inadequate. This is because the number of unfilled teaching positions is often measured (as in the US). This number is used here to define quantity teacher shortage, as shown in formula F8:

F8: (Quantity teacher shortage) = (Number of unfilled teaching positions)

Quality teacher shortage. There are two main ways to define quality teacher shortage in relation to teacher requirements. One is to define the shortage in relation to "teacher need," the other is to define the shortage in relation to "quality teacher demand." Both are described below.

1. Quality teacher shortage in relation to teacher need. As with teacher quantity supply, teacher quality supply is not ordinarily quantified by educational administrators or statisticians. Therefore, a version of formula F1 can not be used to compute quality teacher shortage in relation to a quantified index of teachers needed. Yet, educational administrators can be reasonably confident that there is a significant shortage of teachers. For example, resources exist in Singapore to expand the number of teaching positions as rapidly as novice teachers can be trained. The exact number of teachers needed has not been communicated, but it is greater than the supply of qualified individuals who, in the past, have been able and willing to accept, or retain, employment as teachers. Quality teacher shortage in relation to teacher need could be computed by formula F9.

F9: (Quality teacher shortage) = (Teachers needed) - (Quality teacher supply)

The application of formula F9 requires that a formula be constructed for computing the number of teachers needed and that the qualifications of the supply of available teachers be measured. While both need and supply could be quantified for particular school systems, the writer is not aware of published reports containing such information.

2. Quality teacher shortage in relation to quality teacher demand. Since teacher quality supply is not ordinarily quantified, a version of formula F1 can not be used to compute quality teacher shortage in relation to quality teacher demand. However, it is possible to known if the quantity supply is inadequate. This is because the number of teaching positions that are filled with under-qualified teachers is often measured (as in the US). This number is used here to define quality teacher shortage, such as the shortage of teachers who are fully-licensed for particular teaching positions as shown in formula F10. If desired, this formula can easily be adapted to other teacher quality variables.

F10: (Quality teacher shortage) = (Number of teaching positions not (of licensed teachers) filled by licensed teachers)

Methods for Studying Teacher Shortages

The study of teacher shortage entails the following three basic steps:

1. Develop, or adopt, a teacher shortage model. A teacher shortage model is essential to conceptualize and define the aspect, or aspects, of teacher shortage to be investigated. The first section of this paper provides one such model.

2. Construct a suitable data base for studying teacher shortage. The study of teacher shortages requires a source of data of sufficient quality and size to quantify the variables included in teacher shortage model. Although there are various methods by which this can be accomplished, the two most feasible methods are described below in this section of the paper.

3. Quantify the variables of the model by analyzing the data base. The results of such analyses for teacher shortages in the US are reported in the next section of this paper.

As with any research, the empirical study of teacher shortages requires a source of high quality data. If the study is to address national teacher shortages, then nationally-representative data on teachers and teaching positions are required. The two main approaches that can be taken to constructing such data bases are described below.

Data Bases Derived from Administrative Records

The licensing of teachers in the US occurs at the state level where administrative records are maintained on various attributes of the population of teachers employed in public schools. While researchers have studied many aspects of teacher supply, demand, and shortage with data bases created from

such records, these state data bases have the disadvantage of not being nationally-representative, either separately or in the aggregate (Boe & Gilford, 1992). Thus, conclusions drawn from findings based on state data are currently limited to the state of origin.

It is possible that a national data base on teachers and teaching positions could be constructed in the US by aggregating data from all 50 states. If this were attempted, all states would have to use common definitions of terms and prepare data under standardized conditions so that it could be aggregated into a national data base. This has not been attempted in the US for teacher supply, demand, and shortage data, though it has been accomplished for basic attributes of public and private education such as student enrolment, teacher counts, and financial resources. In other countries with central records on the population of teachers and teaching positions, the construction of a national data base for the study of teacher shortages would be much more feasible than in the US.

Data Bases Derived from Questionnaire Surveys

Data required to study teacher shortages can be collected by questionnaire surveys of teachers and teaching positions. Such data can be secured by sample surveys or population surveys, and can be either cross-sectional or longitudinal. The most important considerations are adequate content coverage, adherence to scientific standards for survey methodology, sufficient sample size to yield reliable data (in the case of sample surveys), and high response rates. In keeping with these methodological standards, questionnaire data suitable for studying "teacher supply and demand" have been collected in the US and could be elsewhere. The data bases derived from these surveys were used to produce the information about teacher shortages reported in the next section. The survey methodology is first described briefly in the following section.

Schools and Staffing Survey: Methodology

In the US, three large-scale sample surveys of teachers, school administrators, schools, and school districts have been conducted during the past decade by the National Center for Education Statistics (NCES) of the US Department of Education (USDE). These surveys, entitled The Schools and Staffing Survey (SASS), were conducted in 1987-88, 1990-91, and 1993-94. Since these surveys were based on large independent national-probability samples with high response rates, and collected a wealth of detailed information relevant to basic dimensions of teacher supply, demand, and shortage, they represent excellent and comprehensive sources of data to study these aspects of the nation's teaching force.

The questionnaires, sample sizes, and response rates for the 1990-91 SASS are shown in Table 1. The source of data for the research on teacher shortages reviewed in the following section was the Public School Teacher Question-

Table 1: THE SCHOOLS AND STAFFING SURVEY: 1990-91

Public Sector Questionnaire	Units Sampled	Available Sample Size	Weighted Response Percentage
Public School Teacher	Public Teachers	46,705	90%
School Administrator	School Principals	9,054	97%
Public School	Public Schools	8,969	95%
Teacher Demand and Shortage	School Districts	4,870	94%

Source: National Center for Education Statistics (NCES), USDE.

naire (PSTQ). More detailed information about the SASS is found in overviews published by NCES (1994) and Boe and Gilford (1992, Appendix B), and in technical descriptions published by NCES (e.g., Choy, Henke, Alt, Medrich, & Bobbitt, 1993, Appendix C).

In keeping with the SASS definition, a teacher was any individual employed either full-time or part-time at a public school in the US who reported their main assignment as teaching in any grade(s) K - 12, including itinerant teachers and long-term substitutes. Excluded from this definition of a teacher were individuals who identified their main assignment as pre-kindergarten teacher, short-term substitute, student teacher, teacher aide, or a non-teaching specialist of any kind.

For the purposes of the research reviewed here, all teachers were classified into two main teaching fields: special education and general education. Special education teachers (SETs) were defined as public school teachers (K - 12) whose main teaching assignment was in any one of a variety of teaching specializations within special education, including other special education. General education teachers (GETs) were then defined as all public school teachers (K - 12) other than SETs.

Based on the SASS sample sizes, weighted national estimates of the numbers of teachers (as well as their percentages and standard errors) were computed by special procedures developed by NCES for complex sample survey data (Kaufman & Huang, 1993). These national estimates were used in the statistical analyses testing for associations among variables. Because SASS data are subject to design effects due to stratification and clustering of the sample, standard errors for the national estimates were computed using the method of balanced repeated replications.

Teacher Shortages in the US: Research Findings from SASS

Studies with the SASS teacher data base for the 1990-91 school year have been conducted to measure quantity teacher shortage and quality teacher shortage (relative to teacher demand) in the US at the national level. The basic findings from several of these studies are reported and discussed in the following two sections. The original reports cited should be consulted for detailed information about technical aspects of the survey methodology, analytic methods, and results such as sample sizes and standard errors of estimate. The findings are reported separately for SETs and GETs employed in public schools. All differences discussed are statistically significant at the .01 level, or higher.

Quantity Teacher Shortage

In accordance with the model of teacher shortage presented above, quantity teacher shortage was defined by formula F8, as follows:

F8: (Quantity teacher shortage) = (Number of unfilled teaching positions)

Based on data from the 1990-91 SASS, it has been reported the supply of teachers was sufficient to fill 99.5% of the total number of teaching positions created and funded for public schools in the US (Choy, et al., 1993). Therefore, the quantity teacher shortage (i.e., the percentage of unfilled teaching positions) in the US as a whole was only 0.5%. A similarly low percentage of teaching positions specifically in special education also appears to have remained unfilled (M. L. Brauen, personal communication, January, 1991).

With such a low percentage of unfilled teaching positions, these findings demonstrate that the problem of teacher shortages in special and general education is not due to unavailability of individuals who are able and willing to accept teaching positions. This circumstance would be very favorable for teaching America's school children if all the individuals employed as teachers were fully qualified in their main teaching assignments. Such is not the case, however. The extent to which this condition has not been attained is addressed in the following section.

Quality teacher shortage

In accordance with the model of teacher shortage presented in the second section of this paper, the most basic aspect of quality teacher shortage was defined by formula F10, as follows:

F10: (Quality teacher shortage (for licensed teachers)) = (Number of teaching positions not filled by licensed teachers)

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Though a number of qualifications and other qualities are sought in the employment of teachers (e.g., degrees earned, type of teacher preparation completed, fields of academic majors, amount of experience, and multiple licenses held), the most basic is for teachers to be fully licensed[4] in their main teaching assignment as defined in formula F10. In fact, this qualification is universal in that all states in the US require all teachers to be fully licensed, though this can be temporarily waived if there is not a fully-licensed teacher available to fill an open position. Because of the universal requirement that teachers be fully-licensed, formula F10 has been defined in terms of the license credential. Accordingly, the study of teacher quality shortage in the US has addressed the extent to which teachers employed in public schools have attained this basic credential.

The studies reviewed below were designed to analyze teacher quality shortages (as defined by formula F10) as a function of the principal sources of teacher supply in the US as depicted in Figure 1 (reproduced from Boe, Cook, Bobbitt, & Terhanian, 1996). The definitions of these sources and other terms are given in the Appendix.

Overall shortage of licensed teachers. The overall shortage of teachers in the US who were fully licensed in their main teaching assignment is shown in Table 2 for "Total Teachers" (data from Boe, Cook, Bobbitt, & Terhanian, 1996). In general education, the shortage of about 125,000 licensed teachers represented 5.5% of the all employed teachers--a very considerable number. The teacher shortage in special education was even more severe, with 9.8% of teaching positions filled by individuals who are not fully licensed. Table 2 also provides teacher shortage information for two major components of total employed teachers: individuals entering public school teaching in the year studied (1990-91) and teachers continuing from the prior year. It can be seen that a much higher percentage of entering teachers did not hold full licenses than continuing teachers (e.g., 19.9% vs. 4.6%, respectively, in general education). More detailed information about shortages in these two major categories of teachers is presented in subsequent tables.

Shortage of Total Employed Teachers as a Function of Their Fields of Earned Degrees. It might be expected that teachers who completed training in the field of their teaching assignment would be more likely to be fully licensed than teachers who did not. The information presented in Table 3 shows that this was indeed the case, and especially for special education teachers (data from Boe, Cook, Bobbitt, & Weber, 1996). The shortage percentages were lower for teachers who had completed a teacher preparation degree in their field of assignment (6.3% in special education and 4.5% in general education), whereas teachers who

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[4]The most common term used in the US is "certification" instead of "license." Whatever term is used, the basic requirement is for a teacher to hold a standard/regular/full license/certification in her or his main teaching assignment. Alternatives are for a teacher to hold some lesser form of license/certification (e.g., provisional, temporary, or emergency) or no license/certification at all.

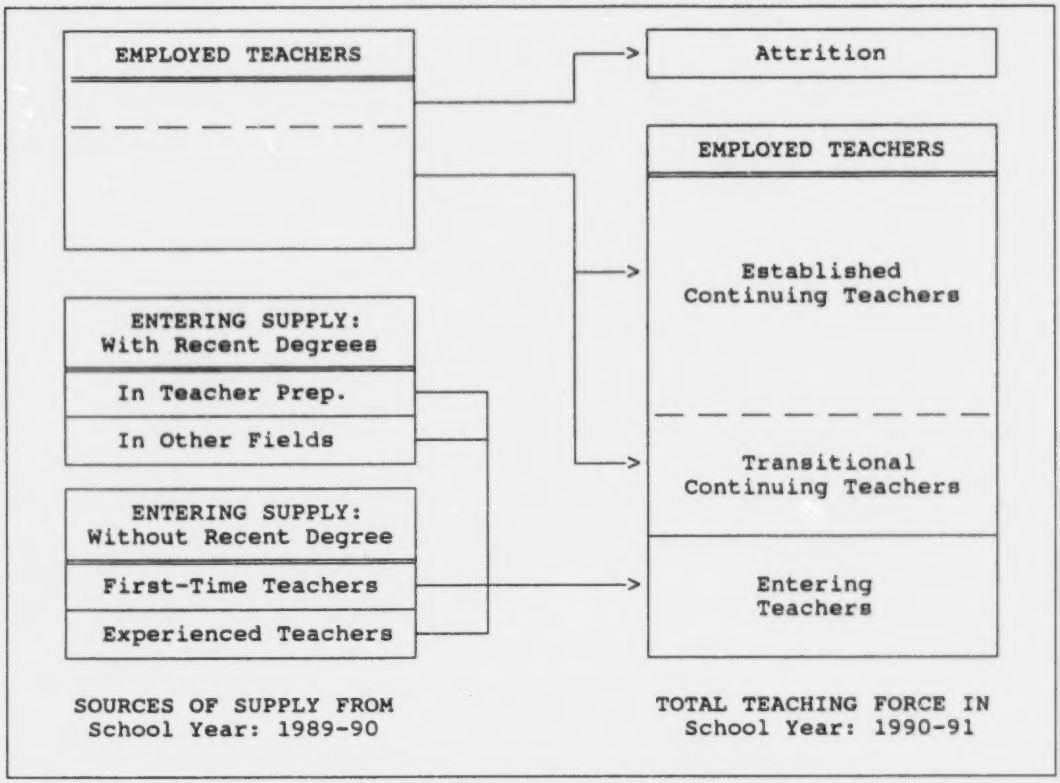

Figure 1. Partial system model of sources of supply of public school teachers from school year 1989-90 to 1990-91.

Table 2: SHORTAGE OF ENTERING AND CONTINUING TEACHERS WHO ARE FULLY-LICENSED IN THEIR MAIN TEACHING ASSIGNMENTS: NATIONAL ESTIMATES FOR SPECIAL AND GENERAL EDUCATION FOR 1990-91

		Teaching Field	
Teacher Status	Statistic	Special Education	General Education
Entering Teachers	National Estimates	7,360	26,896
	Shortage Percentage	31.8%	19.9%
Continuing Teachers	National Estimates	19,440	98,902
	Shortage Percentage	7.8%	4.6%
Total Teachers	National Estimates	26,801	125,797
	Shortage Percentage	9.8%	5.5%

Source: Schools and Staffing Survey: 1990-91, NCES, USDE.

Table 3: SHORTAGE OF FULLY-LICENSED EMPLOYED TEACHERS AS A FUNCTION OF THEIR FIELDS OF EARNED DEGREES: NATIONAL ESTIMATES FOR SPECIAL AND GENERAL EDUCATION FOR 1990-91

Major Fields of Degrees of Total Teachers Who Are Not Fully-Licensed	Statistic	Teaching Field: Special Education	Teaching Field: General Education
Special Education: Teacher Preparation	Shortage Percentage	6.3%	5.9%
General Education Teacher Preparation	Shortage Percentage	14.0%	4.5%
Other Fields or No Degree	Shortage Percentage	27.8%	9.6%
Total Employed Teachers	Shortage Percentage	9.8%	5.5%
	National Estimates	26,801	125,797

Source: Schools and Staffing Survey: 1990-91, NCES, USDE.

Table 4: SHORTAGE OF FULLY-LICENSED ENTERING TEACHERS AS A FUNCTION OF THEIR FIELDS OF EARNED DEGREES: NATIONAL ESTIMATES FOR SPECIAL AND GENERAL EDUCATION FOR 1990-91

Major Fields of Degrees Of Entering Teachers Who Are Not Fully-Licensed	Statistic	Teaching Field: Special Education	Teaching Field: General Education
Special Education: Teacher Preparation	Shortage Percentage	19.3%	-[a]
General Education Teacher Preparation	Shortage Percentage	45.7%	14.7%
Other Fields or No Degree	Shortage Percentage	64.2%	33.5%
Total Entering Teachers	Shortage Percentage	31.8%	19.9%
	National Estimates	7,360	26,896

Source: Schools and Staffing Survey: 1990-91, NCES, USDE.

[a]Sample too small for computing reliable estimate.

had not earned a teacher preparation degree were least likely to be fully licensed (27.8% of such teachers in special education and 9.6% in general education). These data support the common sense principle that teachers should be employed in teaching positions for which they have been trained. Otherwise, they are less likely to be qualified for the positions to which they are assigned.

Shortage of Entering Teachers as a Function of Their Fields of Earned Degrees. As with the total employed teachers discussed above, it might be expected that entering teachers who complete training in the field of their teaching assignment would be more likely to be fully licensed than teachers who did not. The information presented in Table 4 shows the importance of entering teachers receiving appropriate training before becoming teachers(data from Boe, Cook, Bobbitt, & Weber, 1996). In special education, 64.2% of entering teachers were not fully licensed if their degree was in a field other than teacher preparation field, while the comparable number was 33.5% in general education. These results demonstrate that one significant cause of teacher quality shortages was the hiring of teachers who had not completed training for the positions to which they were assigned. The data do not indicate why teachers are assigned to positions out of their fields of training, but it seems quite likely that it was due to a shortage of teachers who were appropriately trained for available teaching positions instead of to simple administrative misassignment.

Shortage of Entering Teachers as a Function of Source of Supply. Entering teachers are hired from several sources of supply, as shown in Figure 1. The yield of fully-licensed entering teachers varies to a great extent with the particular source of supply (see Table 5; data from Boe, Cook, Bobbitt, & Terhanian, 1996). Two sources of teachers yielded the lowest shortage percentages: recent degree graduates of teacher preparation programs (21.2% in special education and 16.2% in general education) and experienced teachers (22.8% in special education and 14.6% in general education). Even though these shortage percentages were of considerable magnitude, the shortage problem was much greater for teachers drawn from other sources. Nonetheless for all sources of entering teacher supply, it must be concluded that there was a serious shortage of teachers who were fully licensed for the positions that needed to be filled.

Shortage of Continuing Teachers as a Function of Their Stability in Teaching Positions. All continuing teachers (as shown in Table 2) were subdivided into two parts: (a) those who had remained in the same main teaching assignment and school for at least the past three consecutive years (called established teachers), and (b) those who had not--a group who had changed school or assignment within the past three years (called transitional teachers). The information shown in Table 6 demonstrates that the shortage percentage for fully-licensed teachers was much lower for established teachers than for transitional teachers (data from Boe, Cook, Bobbitt, & Terhanian, 1996). In fact, the shortage percentages for established SETs (4.6%) was comparably low to that for

Table 5: SHORTAGE OF FULLY-LICENSED ENTERING TEACHERS AS A FUNCTION OF SOURCE OF TEACHER SUPPLY: NATIONAL ESTIMATES FOR SPECIAL AND GENERAL EDUCATION FOR 1990-91

Sources of Supply of Entering Teachers Who Are Not Fully-Licensed	Statistic	Teaching Field: Special Education	Teaching Field: General Education
With Recent Degrees			
In Any Teacher Preparation Program	Shortage Percentage	21.2%	16.2%
In Other Fields	Shortage Percentage	-[a]	33.0%
No Recent Degree			
First-Time Teachers	Shortage Percentage	68.4%	28.4%
Experienced Teachers	Shortage Percentage	22.8%	14.6%
Total Entering Teachers	Shortage Percentage	31.8%	19.9%
	National Estimates	7,360	26,896

Source: Schools and Staffing Survey: 1990-91, NCES, USDE.
[a]Sample too small for computing reliable estimate.

Table 6: SHORTAGE OF FULLY-LICENSED CONTINUING TEACHERS AS A FUNCTION OF STABILITY IN THEIR TEACHING ASSIGNMENT AND SCHOOL: NATIONAL ESTIMATES FOR SPECIAL AND GENERAL EDUCATION FOR 1990-91

Stability of Teachers Who Are Not Fully-Licensed	Statistic	Teaching Field: Special Education	Teaching Field: General Education
Established Teachers	Shortage Percentage	4.6%	3.2%
Transitional Teachers	Shortage Percentage	14.4%	9.9%
Total Continuing Teachers	Shortage Percentage	7.8%	4.6%
	National Estimates	19,440	98,902

Source: Schools and Staffing Survey: 1990-91, NCES, USDE.

established GETs (3.2%). The higher shortage percentages for transitional teachers demonstrated that instability (i.e.,turnover) was associated with higher shortages, apparently because there was not a sufficient supply of fully-licensed teachers who are able and willing to accept the open teaching positions that needed to be filled. Therefore, less qualified individuals were hired into these positions so that someone would be present to take charge of these classrooms when students arrived.

Conclusion

The research findings reported here demonstrate that models and methods exist for quantifying the shortages of teachers in terms of gross numbers and of various qualifications. Furthermore, in computing both types of shortages, these methods are sufficiently precise to take into account the demand for teachers in particular positions that are distributed widely over different subject matters, educational levels, schools, and locations. The quantification of teacher shortages requires (a) precise definition of the shortage variable(s) to be measured and (b) a suitable data base. However, it is typically difficult and expensive to construct a teacher data base of sufficient content, quality, and representativeness to quantify teacher shortages with acceptable precision.

The information reviewed here on the shortage of teachers in the US demonstrated that this was a problem related to the basic qualifications of teachers instead of to the gross numbers of individuals willing and able to accept employment as teachers, i.e., it was a quality problem instead of a quantity problem. As might be expected, the findings revealed that the shortage of qualified teachers was more pronounced among (a) teachers who had not earned degrees in teacher preparation, (b) novice teachers upon entering the profession, (c) employed teachers who had recently changed teaching assignment (either the subject matter or school, or both), and (d) teachers of handicapped children (special education teachers).

To place the teacher shortage problem in perspective, there were about 150,000 employed teachers in the US in 1990-91 who were not fully licensed in their teaching assignment. In comparison with this shortage of 150,000 licensed teachers, all teacher training institutions graduated about 145,000 degreed teachers in 1990-91, an estimated 50,000 of whom would never become teachers (Boe, Bobbitt, Cook, & Weber, 1996). The failure of 50,000 trained teachers in one year to find suitable employment in the profession suggests that the production of teachers does not closely match the demand for teachers when desegregated by subject matter, level, school, and location.

In addition, the annual attrition of teachers requires that about 160,000 entering teachers be hired each year, of whom about 35,000 are not fully licensed (Boe, Cook, Bobbitt, & Terhanian, 1996). Although there are additional dimensions of the teacher supply and shortage to be considered, the factors reviewed above suggest that the shortage of fully licensed teachers is a serious

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problem, and not likely to be improved appreciably by the level of current production of teacher preparation programs.

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APPENDIX

Definitions of Sources of Teacher Supply and Other Terms

Teacher Categories

1. Entering teachers. Entering teachers were defined as individuals who where not teaching in public schools during 1989-90, and who commenced teaching in a public school during 1990-91. Entering teachers were subdivided into those who had recently earned a college degree and those who had not recently earned a college degree.

   a. Entering teacher supply: With recent degrees. Entering teachers with recent degrees were individuals who had earned a college or university degree at the bachelor's or graduate levels during calendar year 1990. Some entering teachers with recent degrees were first-time teachers, i.e., those who had no prior teaching experience in either public or private schools, other than possibly as teacher aides, student teachers, or short-term substitute teachers. Other entering teachers with recent degrees were experienced teachers--mostly former teachers who had left teaching and a few private school teachers who were migrating to public schools. All such recent graduates were further subdivided into those who had earned degrees with a major in a teacher preparation program and those who had majored in some other field.

      (1) With degrees in teacher preparation. Recent graduates were classified as having earned a degree in a teacher preparation program if (a) the degree earned was at the bachelor's or master's degree levels, and (b) the major field of study was in a teacher preparation program in either special or general education.

      (2) With degrees in other fields. Recent graduates were classified as having earned a degree in fields other than teacher preparation if (a) the degree earned was at the bachelor's or graduate levels, and (b) the major field of study was not in teacher preparation.

   b. Entering teacher supply: Without recent degree. Entering teachers with no recent degree were individuals who had not earned a college or university degree at the bachelor's or graduate levels during calendar year 1990. These entering teachers were subdivided further into (a) those who were first-time teachers who had delayed their entry to the profession by one or more years, and (b) those who had prior teaching experience.

      (1) First-time teachers without recent degree. First-time teachers were defined as entering teachers who had no prior teaching experience, other than possibly as teacher aides, student teachers, or short-term substi-

tute teachers. The first-time teachers classified here had not earned a degree in 1990 and, therefore, had delayed their entry to the profession in comparison with entering teachers who had recently earned a degree in 1990.

(2) Experienced teachers without recent degree. Entering experienced teachers were defined as entering teachers who had prior experience as regular, itinerant, or long-term substitute teachers in either public or private schools. Private school migrant teachers were classified as entering experienced teachers. The experienced teachers classified here had not earned a degree in 1990.

2. Continuing teachers. Continuing teachers were defined as teachers who were teaching in a public school during 1989-90, and who continued teaching in a public school during 1990-91. Continuing teachers were subdivided into two types representing "stability" in teaching assignments over time: established teachers and transitional teachers.

a. Established continuing teachers. Established teachers were defined as continuing teachers who had remained in one of 53 specific teaching assignment fields recognized by SASS and who had taught in the same school for at least three consecutive years, viz, during the 1988-89, 1989-90, and 1990-91 school years.

b. Transitional continuing teachers. Transitional teachers were defined as all continuing teachers who were not classified as established teachers. Thus, transitional teachers included (a) continuing teachers who had changed teaching assignment and/or school since 1988-89, and (b) those who had entered public school teaching during 1989-90 (i.e., too recently to have had sufficient years of service to qualify as established teachers).

Major Field of Study for Earned Degrees

The major field of study for degrees earned at the bachelor's level or higher was analyzed separately for total employed teachers and for entering teachers in 1990-91. The three major fields of study analyzed in this research were as follows:

1. Teacher preparation in special education. SETs who had earned either a bachelor's or master's degree with a major field of study in any one of 11 teacher preparation categories in special education, as recognized by the PSTQ, were classified as having graduated from a teacher preparation program in special education regardless of whether they also held a degree in any other field of study. GETs who likewise had earned either a bachelor's or master's degree with a major field of study in any one of the 11 teacher preparation categories in special education were classified as having graduated from a teacher preparation program in special education unless they had also graduated from a teacher preparation program in general education.

2. Teacher preparation in general education. GETs who had earned either a bachelor's or master's degree with a major field of study in any one of 21 teacher preparation categories in general education, as recognized by the PSTQ, were classified as having graduated from a teacher preparation program in general education regardless of whether they also held a degree in any other field of study. SETs who likewise had earned either a bachelor's or master's degree with a major field of study in any one of 21 teacher preparation categories in general education were classified as having graduated from a teacher preparation program in general education unless they had also graduated from a teacher preparation program in special education.
3. All other fields. All teachers who were not classified as having earned a bachelor's or master's degree from a teacher preparation program in either special or general education were classified as having majored in some other field of study. Also classified here were the few teachers (<1.0%) who had not earned a bachelor's degree.

Teacher Licensure Status

Licensure status was defined in terms of the type of license held in a teacher's current main teaching assignment. Two levels of licensure were identified:

1. Fully licensed in main teaching assignment. A fully-licensed teacher was defined as a teacher who qualified for either an advanced professional certificate, a regular or standard state certificate, or a probationary certificate (all requirements satisfied except for completion of a probationary period) in the field of their main teaching assignment.
2. Partly licensed in main teaching assignment. All teachers who were not fully licensed were classified as partly-licensed teachers. Most of these teachers would have qualified for a temporary, provisional, or emergency certificate, though some may have held no certificate at all in their main teaching assignment.